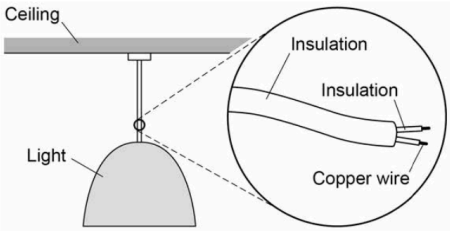
Q1. (2018)

0 4 Some ceiling lights in the home are connected to the mains by a two-core cable.

Figure 6 shows a ceiling light.

Figure 6



a)

0 4 . 2 Write down the equation that links charge flow, current and time.

[1 mark]

b)

0 4 . 3 There is a current of 2.95 A in one of the copper wires for 60 seconds.

Calculate the charge flow through the wire.

Use your equation from question **04.2**

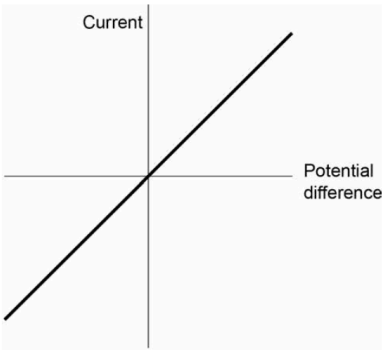
[2 marks]

Charge flow = _____ C

c)

0 4 . 4 **Figure 7** shows a current potential difference graph for a piece of copper wire.

Figure 7



Draw another line on **Figure 7** for a wire with a different resistance.

[2 marks]

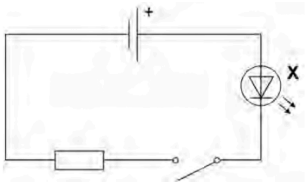
Q2. (2019)

0 1 A designer made some shoes that have lights in them.

Each shoe has a switch which closes when a person puts their foot on the floor.

Figure 1 shows the circuit.

Figure 1



a)

0 1 . 1 What is component **X**?

[1 mark]

Tick (✓) **one** box.

Lamp ☐

LDR ☐

LED ☐

b)

0 1 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

greater than	**less than**	**the same as**

When the switch was closed, the current in component **X** was

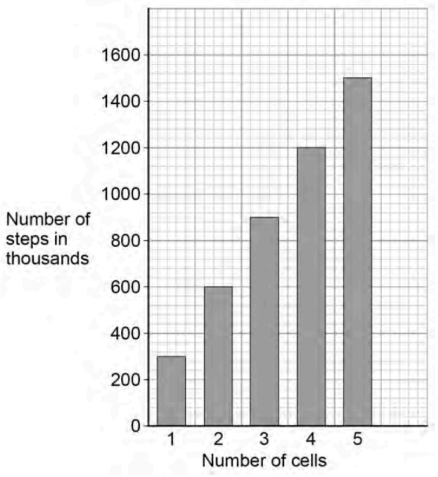
_____ the current in the resistor.

c)

The designer tested how the number of cells affected the number of steps that could be taken before the lights stopped working.

Figure 2 shows the results.

Figure 2



0 1 . 3 Determine how many more steps could be taken when the number of cells was increased from 3 to 5

[2 marks]

Number of steps = _____ thousand

d)

0 1 . 4 How could the designer check the repeatability of the results?

[1 mark]

Tick (✓) **one** box.

Repeat the experiment with a different resistor in the circuit. ☐

Repeat the experiment using exactly the same method. ☐

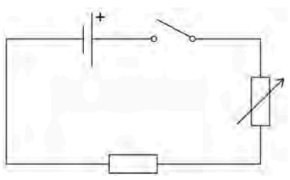
Repeat the experiment with different types of shoe. ☐

Q3. (2019)

0 6 A student investigated how the current in a resistor varies with the potential difference across the resistor.

Figure 8 shows part of the circuit used.

Figure 8



a)

0 6 . 1 The student connected an ammeter and a voltmeter into the circuit.

What is the correct way to connect the ammeter and the voltmeter into the circuit?

[1 mark]

Tick (✓) **one** box.

Ammeter	Voltmeter	
In parallel with the resistor	In series with the resistor	☐
In parallel with the cell	In series with the resistor	☐
In series with the resistor	In parallel with the resistor	☐
In series with the resistor	In parallel with the cell	☐

b)

0 6 . 2 The student increased the resistance of the variable resistor.

How did increasing the resistance affect the current in the circuit?

[1 mark]

c)

0 6 . 3 How should the student change the circuit to give negative values for current and potential difference?

[1 mark]

d)

0 6 . 4 Name the type of relationship between current and potential difference for a resistor at constant temperature.

[1 mark]

e)

0 6 . 5 Write the equation which links current, potential difference and resistance.

[1 mark]

f)

0 6 . 6 The current in the resistor was 0.12 A when the potential difference across the resistor was 3.0 V

Calculate the resistance of the resistor.

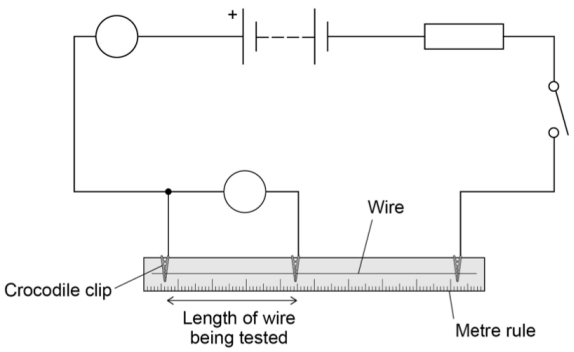
[3 marks]

Q4. (2020)

0 1 A student investigated how the resistance of a wire varies with the length of the wire.

Figure 1 shows the circuit used.

Figure 1



a)

0 1 . 1 The symbols for the voltmeter and ammeter in **Figure 1** are **not** complete.

Complete the symbols for the voltmeter and ammeter in **Figure 1**.

[1 mark]

b)

0 1 . 2 Which variable is the independent variable?

[1 mark]

Tick (✓) **one** box.

- The current in the wire ☐
- The length of the wire being tested ☐
- The resistance of the wire ☐
- The thickness of the wire ☐

c)

0 1 . 3 Which variable is the dependent variable?

[1 mark]

Tick (✓) **one** box.

- The current in the wire ☐
- The length of the wire being tested ☐
- The resistance of the wire ☐
- The thickness of the wire ☐

d)

0 1 . 4 The student took repeat readings of potential difference for a 30 cm length of the wire.

The readings were:

0.16 V 0.17 V 0.15 V

Calculate the mean potential difference.

[2 marks]

e)

The length of the wire was increased to 60 cm

The current in the wire was 0.50 A

The mean potential difference across the wire was 0.32 V

0 1 . 5 Calculate the resistance of the 60 cm length of wire.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

[2 marks]

f)

0 1 . 7 Calculate the charge flow when there is a current of 0.50 A in the wire for 17 s

Use the equation:

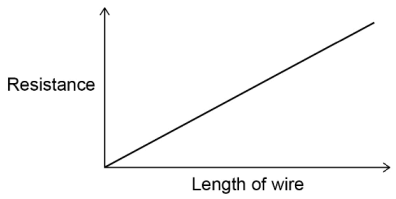
$$\text{charge flow} = \text{current} \times \text{time}$$

[2 marks]

g)

0 1 . 8 **Figure 2** is a sketch graph of the results.

Figure 2



The student repeated the investigation using a thicker wire made from the same metal. For the same length, the thicker wire has a lower resistance.

Draw a line on **Figure 2** to show how the resistance of the thicker wire varies with length.

[1 mark]

Q5. (2021)

0 3 . 2 What is meant by an electric current?

[1 mark]

Tick (✓) **one** box.

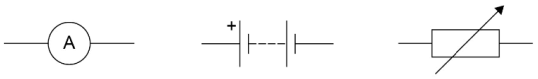
- The energy carried by each unit of charge ☐
- The flow of electrical charge ☐
- The number of electrons in a circuit ☐
- The speed at which charge moves ☐

Q6. (2021)

A manufacturer investigated the maximum current value of some filament lamps.

Figure 6 shows the symbols for an ammeter, a battery and a variable resistor.

Figure 6



Ammeter Battery Variable resistor

The manufacturer connected an ammeter, battery, filament lamp and variable resistor in series.

a)

0 3 . 4 How could the manufacturer increase the current in the filament lamp?

[1 mark]

Tick (✓) **one** box.

- Add an extra ammeter to the circuit. ☐
- Decrease the resistance of the variable resistor. ☐
- Use a battery with a smaller potential difference. ☐

b)

0 3 . 6 Write down the equation which links charge flow (Q), current (I) and time (t).

[1 mark]

c)

0 3 . 7 The manufacturer increased the current in the filament lamp to 200 mA.

Calculate the charge flow through the filament lamp in 15 s.

[3 marks]

d)

0 3 . 8 The manufacturer increased the current in the filament lamp from 200 mA.

The filament in the lamp broke when the current reached 320 mA.

How many times greater than 200 mA was the current at which the filament broke?

[1 mark]

e)

0 3 . 9 The manufacturer tested lots of filament lamps.

The current at which the filament lamps broke was 320 ± 60 mA.

What is the range of currents at which the filament lamps broke?

[1 mark]

Tick (✓) **one** box.

- 60 mA to 320 mA ☐
- 260 mA to 320 mA ☐
- 320 mA to 380 mA ☐
- 260 mA to 380 mA ☐

Q7. (2021)

0 5 **Figure 9** shows a mobile phone with its battery removed.

Figure 9

A student measured the potential difference across the battery and then put the battery into the phone.

a)

0 5 . 1 What is the equation linking current (I), potential difference (V) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$I = V R$ ☐

$R = I V$ ☐

$V = I R$ ☐

$V = I^2 R$ ☐

b)

0 5 . 2 The current in the electronic circuit in the mobile phone was 0.12 A.

The potential difference across the battery was 3.9 V.

Calculate the resistance of the electronic circuit in the mobile phone.

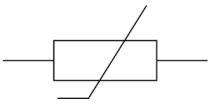
[3 marks]

c)

The mobile phone includes a sensor to monitor the temperature of the battery.

Figure 10 shows the circuit symbol for a component used in the sensor.

Figure 10



0 5 . 5 What component does the circuit symbol shown in **Figure 10** represent?

[1 mark]

d)

0 5 . 6 The temperature of the component in **Figure 10** increases.

The potential difference across the component remains constant.

Explain what happens to the current in the component.

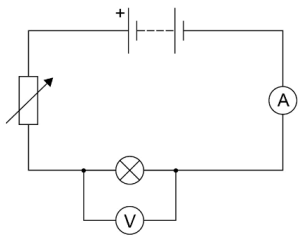
[2 marks]

Q8. (2022)

0 1 A student investigated how the potential difference across a filament lamp affects the current in the lamp.

Figure 1 shows the circuit the student used.

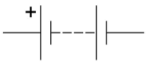
Figure 1



a)

0 1 . 1 **Figure 2** shows a circuit symbol.

Figure 2



What component does the symbol represent?

[1 mark]

Tick (✓) **one** box.

- Ammeter ☐
- Battery ☐
- Lamp ☐
- Variable resistor ☐

b)

0 1 . 2 Which component from **Figure 1** did the student use to adjust the potential difference across the lamp?

[1 mark]

c)

0 1 . 3 When the voltmeter was **not** connected to the circuit it gave a reading of 0.4 volts.

How can the student correct all the readings taken from the voltmeter?

[1 mark]

Tick (✓) **one** box.

- Add 0.4 volts to each reading ☐
- Divide each reading by 0.4 volts ☐
- Multiply each reading by 0.4 volts ☐
- Subtract 0.4 volts from each reading ☐

d)

0 1 . 4 The student recorded three values of current for each potential difference.

Table 1 shows the results for 2.5 volts.

Table 1

Potential difference in volts	Current in amps		
	1	2	3
2.5	0.54	0.58	0.53

Calculate the mean current in the lamp.

[2 marks]

e)

0 1 . 6 Calculate the resistance of the lamp when the potential difference across the lamp was 4.8 V

The current in the lamp was 0.75 A

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

[2 marks]

f)

0 1 . 7 Complete the sentence.

Choose answers from the box.

Each answer may be used once, more than once or not at all.

[2 marks]

decrease	**increase**	**stay the same**

Increasing the current in a filament lamp makes the temperature

of the lamp _____ and the

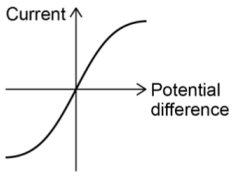
resistance of the lamp _____ .

g)

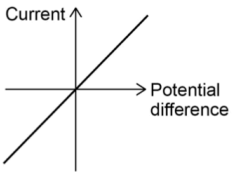
0 1 . 8 Which graph shows the relationship between potential difference and current for a filament lamp?

[1 mark]

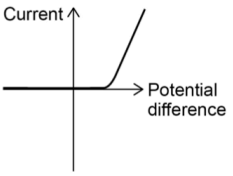
Tick (✓) **one** box.



☐



☐



☐

Q9. (2023)

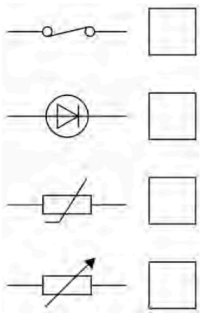
0 4 A gardener wanted to build an electrical circuit to monitor the temperature in a greenhouse.

a)

0 4 . 1 Which symbol represents an electrical component with a resistance that decreases as its temperature increases?

[1 mark]

Tick (✓) **one** box.



b)

0 4 . 2 When the resistance of an electrical circuit decreases, the current in the circuit increases.

Complete the sentence.

Choose the answer from the box.

[1 mark]

charge	**energy**	**potential difference**	**power**

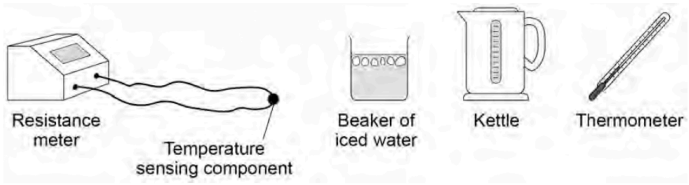
Electrical current is a flow of _____ .

c)

0 4 . 3 The gardener wanted to find how the resistance of the component varies with temperature.

Figure 4 shows the equipment used by the gardener.

Figure 4



The resistance meter displays the resistance of the component.

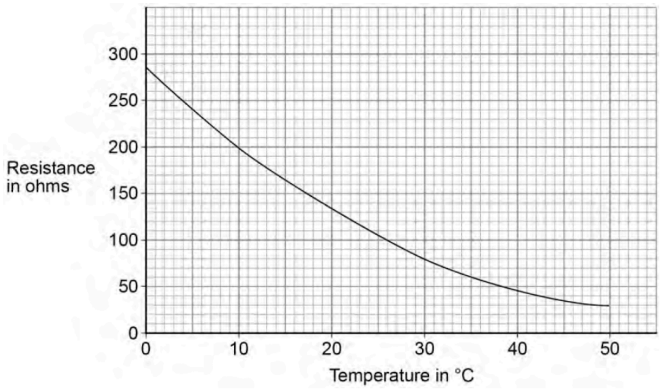
Plan a method the gardener could use to find how the resistance of the component varies with temperature.

[4 marks]

d)

Figure 5 shows how the resistance of the component varies with temperature.

Figure 5



0 4 . 4 Complete the sentence.

Choose the answer from the box.

[1 mark]

linear	**non-linear**	**directly proportional**

The relationship between the temperature and the resistance of the component is _____ .

e)

0 4 . 5 The temperature in the greenhouse changed from 10 °C to 30 °C.

Determine the change in resistance of the component between these temperatures.

Use **Figure 5**.

[2 marks]

Q10. (2023)

0 6 Body analysis scales use the electrical resistance of a person's legs to estimate the percentage of water in the person's body.

Figure 8 shows body analysis scales.

Figure 8

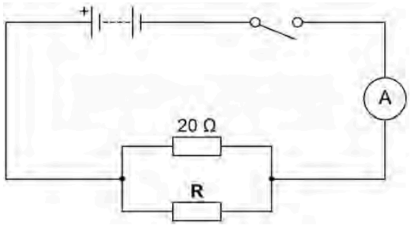
The person's legs contain both solid tissue and water.

A student used resistors to model the solid tissue and water.

The student connected a 20 Ω resistor in parallel with a resistor, **R**.

Figure 9 shows the circuit diagram.

Figure 9



a)

Use the Physics Equations Sheet to answer questions **06.3** and **06.4**.

0 6 . 3 Write down the equation that links current (*I*), resistance (*R*) and potential difference (*V*).

[1 mark]

b)

0 6 . 4 When the total resistance of the resistors was 7.5 Ω the current in the circuit was 480 mA.

Calculate the potential difference across the two resistors.

[3 marks]

c)

The student investigated how the resistance of **R** affected the total resistance of the circuit.

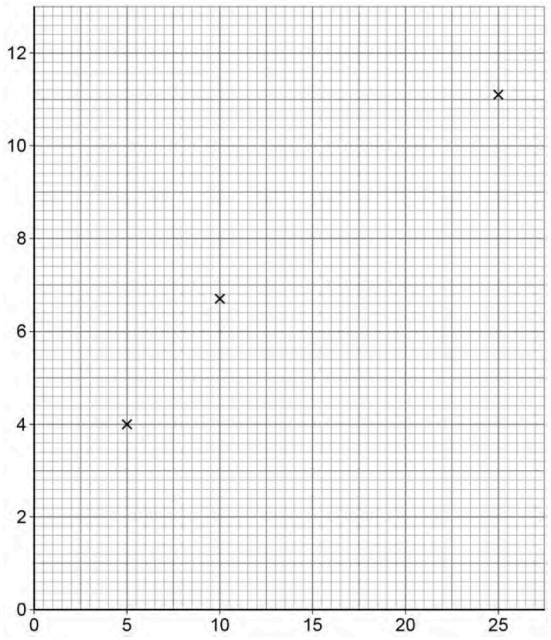
Table 2 shows the results.

Table 2

Resistance of R in ohms	Total resistance of the circuit in ohms
5.0	4.0
10.0	6.7
15.0	8.6
20.0	10.0
25.0	11.1

Some of the results are plotted in **Figure 10**.

Figure 10



0 6 . 5 Complete **Figure 10**.

You should:

- label both axes
- plot the two remaining values from **Table 2**
- draw the line of best fit.

[3 marks]

d)

0 6 . 6 What resistance of **R** would give a total resistance of 4.4 Ω?

Use **Figure 10**.

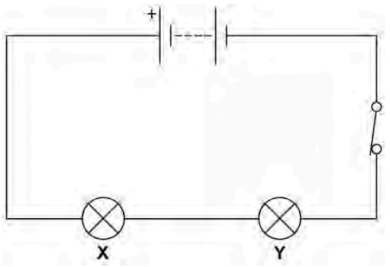
[1 mark]

Resistance of **R** = _____ Ω

Q11. (2024)

0 1 **Figure 1** shows a circuit diagram. The circuit contains a battery and two lamps, **X** and **Y**.

Figure 1



a)

0 1 . 4 Calculate the resistance of lamp **X**.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

[2 marks]

b)

0 1 . 5 The current in lamp **X** is 1.2 A.

Calculate the charge flow through lamp **X** in 40 seconds.

Use the equation:

charge flow = current × time

[2 marks]

c)

0 1 . 6 The switch can be used to turn the lamps on and off.

Immediately after the lamps are switched on, the resistance of each lamp increases.

Why does the resistance of each lamp increase?

[1 mark]

Tick (✓) **one** box.

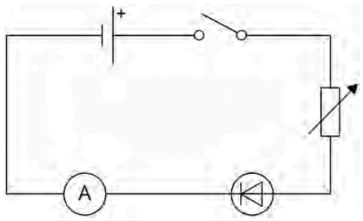
- The current in the battery decreases. ☐
- The potential difference across each lamp decreases. ☐
- The power of the battery increases. ☐
- The temperature of each lamp increases. ☐

Q12. (2024)

0 4 A student investigated how the current in a diode varies with the potential difference across the diode.

Figure 6 shows an incomplete diagram of the circuit used.

Figure 6



a)

0 4 . 1 The student measured the potential difference across the diode.

Complete **Figure 6** by adding the symbol for a voltmeter in the correct position.

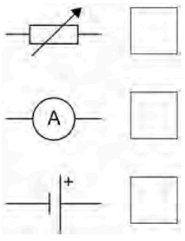
[2 marks]

b)

0 4 . 2 Which component should the student adjust to change the potential difference across the diode?

[1 mark]

Tick (✓) **one** box.



c)

The student measured the current three times for each value of potential difference.

0 4 . 3 Complete the sentence.

Choose the answer from the box.

[1 mark]

random	**systematic**	**zero**

When the potential difference was 1.50 V the current measurements varied between 0.95 A and 1.08 A. This was caused by _____ errors.

d)

0 4 . 4 For one value of potential difference, the measurements of current were:

0.27 A 0.32 A 0.31 A

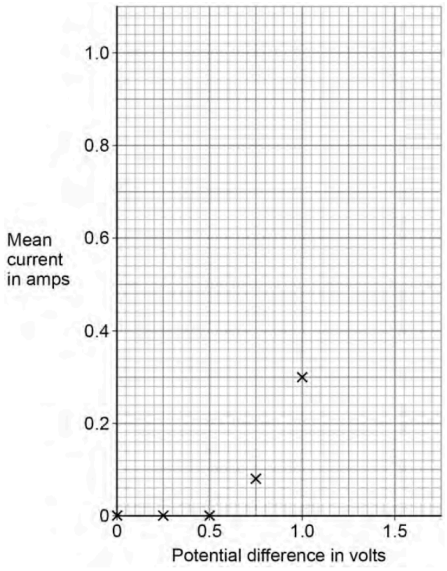
Calculate the mean current.

[2 marks]

e)

Figure 7 shows some of the results.

Figure 7



0 4 . 5 **Table 2** shows the results when the potential difference was greater than 1.00 V.

Table 2

Potential difference in volts	Mean current in amps
1.25	0.60
1.50	1.00

Complete **Figure 7**.

You should:

- plot the results from **Table 2**
- draw a line of best fit.

[2 marks]

f)

0 4 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

directly proportional	**inversely proportional**	**non-linear**

Figure 7 shows that the relationship between potential difference and current for the diode is _____.

g)

0 4 . 7 The student adjusted the circuit so that the current in the diode was 1.00 A.

The student then reversed the connections to the diode.

What happened to the current in the diode when the connections were reversed?

[1 mark]

Tick (✓) **one** box.

The current decreased to 0.00 A. ☐

The current remained at 1.00 A. ☐

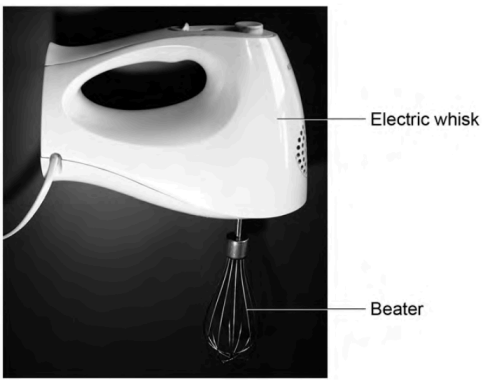
The current increased to 2.00 A. ☐

Q13. (2024)

0 6 **Figure 10** shows an electric whisk that plugs into the mains electricity supply.

The whisk can mix food by spinning a beater.

Figure 10



The whisk has several settings that allow the beater to spin at different speeds.

A faster beater speed needs a greater power input from the mains electricity supply.

0 6 . 7 Changing the beater speed does **not** change the potential difference between the live wire and neutral wire.

The power input to the whisk changes because the current in the whisk changes.

Complete the sentence.

[1 mark]

When the beater speed increases, the current in the whisk increases because the resistance of the whisk _____.